

What is claimed is:

1. A vehicle-use bearing apparatus comprising:  
a hub wheel to which a wheel is attached; and  
a double row tapered roller bearing with vertex of  
5 contact angles outside of bearing to be attached to an outer  
periphery of said hub wheel,

wherein a shaft end of said hub wheel is deformed  
outwardly in a radial direction so as to be caulked to an  
outer end surface of an inner ring of said tapered roller  
10 bearing,

wherein said tapered roller bearing has an inner ring  
and an outer ring whose rolling contact surfaces are tapered,  
and a tapered roller which is arranged between the rolling  
contact surface of said inner ring and the rolling contact  
15 surface of said outer ring,

wherein a form of a raceway track of at least one of  
said inner and outer rings is designed so as to satisfy a  
condition that a predetermined form is secured in a state  
that the raceway track is elastically deformed by the  
20 caulking.

2. The vehicle-use bearing apparatus according to  
claim 1, wherein the condition is such that the form of the  
raceway track of at least one of said inner and outer rings  
before caulking is set so that an extended line along one  
25 of the rolling contact surface and an extended line along  
an outer peripheral surface of said tapered roller meet at  
a rotational axis of said hub wheel after the caulking.

3. The vehicle-use bearing apparatus according to  
claim 1, wherein the condition is such that the forms of the  
30 raceway tracks of said inner and outer rings before the  
caulking are set so that extended lines along the rolling  
contact surfaces of said outer and inner rings and an extended

line along an outer peripheral surface of said tapered roller meet at a rotational axis of said hub wheel.

4. The vehicle-use bearing apparatus according to claim 1, wherein the condition is such that an angle of the rolling contact surface of said inner ring before the caulking is set to an angle obtained by subtracting a fluctuation angle of the rolling contact surface due to the caulking from an angle of the rolling contact surface where the raceway track of said inner ring secures a required form.

5. The vehicle-use bearing apparatus according to claim 1, wherein the condition is such that an angle of the rolling contact surface of said outer ring is set to an angle obtained by adding a fluctuation angle of the rolling contact surface of said inner ring due to the caulking to an angle of the rolling contact surface where the raceway track of said outer ring secures a required form.

6. A vehicle-use bearing apparatus comprising:  
a hub wheel to which a wheel is attached; and  
a double row tapered roller bearing with vertex of contact angles outside of bearing to be attached to an outer periphery of said hub wheel,

wherein a shaft end of said hub wheel is deformed outwardly in a radial direction so as to be caulked to an outer end surface of an inner ring of said bearing,

wherein said tapered roller bearing has an inner ring and an outer ring whose rolling contact surfaces are tapered, a tapered roller which is arranged between said inner and outer rings, and a cone back face rib which is expanded outwardly in the radial direction to a large diameter side of the rolling contact surface of said inner ring,

wherein a raceway track of said outer ring is a rolling contact surface of said outer ring,

wherein a raceway track of said inner ring is the rolling contact surface of said inner ring and an inner wall surface of said cone back face rib,

wherein a form of at least one of the race way tracks  
5 of said outer and inner rings is designed so as to satisfy a condition that the raceway track secures a predetermined form in a state that the raceway track is elastically deformed due to the caulking.

7. The vehicle-use bearing apparatus according to  
10 claim 6, wherein the condition is such that the form of the raceway track of at least one of said inner and outer rings before caulking is set so that an extended line along one of the rolling contact surface and an extended line along an outer peripheral surface of said tapered roller meet at  
15 a rotational axis of said hub wheel after the caulking.

8. The vehicle-use bearing apparatus according to claim 6, wherein the condition is such that an angle of the rolling contact surface of said inner ring before the caulking is set to an angle obtained by subtracting a  
20 fluctuation angle of the rolling contact surface due to the caulking from an angle of the rolling contact surface where the raceway track of said inner ring secures a required form.

9. The vehicle-use bearing apparatus according to claim 6, wherein the condition is such that an angle of the  
25 rolling contact surface of said inner ring before the caulking is set to an angle obtained by subtracting a fluctuation angle of the rolling contact surface due to the caulking from an angle of the rolling contact surface where the raceway track of said inner ring secures a required form,  
30 and a tilt angle of the inner wall surface of said cone back face rib with respect to the radial direction before the caulking is set to an angle obtained by adding a fluctuation

tilt angle due to the caulking to a tilt angle after the caulking.

10. The vehicle-use bearing apparatus according to claim 6, wherein the condition is such that an angle of the rolling contact surface of said outer ring is set to an angle  
5 obtained by adding a fluctuation angle of the rolling contact surface of said inner ring due to the caulking to an angle of the rolling contact surface where the raceway track of said outer ring secures a required form.

10 11. A vehicle-use bearing apparatus comprising:

a hub wheel to which a wheel is attached; and

a double row tapered roller bearing with vertex of contact angles outside of bearing to be attached to an outer periphery of said hub wheel,

15 wherein said tapered roller bearing includes a single outer ring having two row rolling contact surfaces adjacent in an axial direction, a plurality of tapered rollers arranged on said two row rolling contact surfaces, and an inner ring which has a single rolling contact surface paired  
20 with the rolling contact surface on a vehicle inner side of said outer ring and is fitted to the vehicle inner side on an outer peripheral surface in said hub wheel, and a required area of the outer peripheral surface of said hub wheel is utilized as a rolling contact surface paired with the rolling  
25 contact surface on the vehicle outer side of said outer ring,

wherein the vehicle inner side of said hub wheel is of a hollow form, and the vehicle inner side is bent outwardly in a radial direction so as to be caulked to an end surface of said inner ring in said bearing,

30 wherein a raceway track of at least one of said outer and inner rings of said tapered roller bearing is designed so as to satisfy a condition that a predetermined form is

secured in a state that the raceway track is elastically deformed due to the caulking.

12. The vehicle-use bearing apparatus according to claim 11, wherein:

5        said inner ring has a tapered rolling contact surface on its outer periphery and a cone back face rib which is expanded outwardly in the radial direction to a large diameter side of the tapered rolling contact surface, and the raceway track of said inner ring is said tapered rolling  
10 contact surface and an inner wall surface of said cone back face rib; and

      said outer ring has only a tapered rolling contact surface on its inner periphery, and the raceway track of said outer ring is the tapered rolling contact surface.

15        13. The vehicle-use bearing apparatus according to claim 11, wherein the condition is such that forms of the raceway tracks of said inner and outer rings before the caulking are set so that extended lines along the rolling contact surfaces of said outer and inner rings and an extended  
20 line along an outer peripheral surface of said tapered roller meet at a rotational axis of said hub wheel after the caulking.

      14. The vehicle-use bearing apparatus according to claim 11, wherein the condition is such that an angle of the  
25 rolling contact surface of said inner ring before the caulking is set to an angle obtained by subtracting a fluctuation angle of the rolling contact surface due to the caulking from an angle of the rolling contact surface where the raceway track of said inner ring secures a required form.

30        15. The vehicle-use bearing apparatus according to claim 11, wherein the condition is such that an angle of the rolling contact surface of said inner ring before the

caulking is set to an angle obtained by subtracting a fluctuation angle of the rolling contact surface of said inner ring due to the caulking from an angle of the rolling contact surface where the raceway track of said inner ring  
5 secures a required form, and a tilt angle of the inner wall surface of said cone back face rib before the caulking is set to an angle obtained by adding a fluctuation tilt angle due to the caulking to a tilt angle after the caulking.

16. The vehicle-use bearing apparatus according to  
10 claim 11, wherein the condition is such that an angle of the rolling contact surface of said outer ring is set to an angle obtained by adding a fluctuation angle of the rolling contact surface of said inner ring due to the caulking to an angle of the rolling contact surface where the raceway track of  
15 said outer ring secures a required form.

17. A vehicle-use bearing apparatus comprising:  
a hub wheel to which a wheel is attached; and  
a double row tapered roller bearing with vertex of  
contact angles outside of bearing to be attached to an outer  
20 periphery of said hub wheel,

wherein said tapered roller bearing includes a single outer ring having two row rolling contact surfaces adjacent in an axial direction, an inner ring on a vehicle inner side corresponding to the rolling contact surface of said outer  
25 ring on the vehicle inner side, an outer ring on a vehicle outer side corresponding to the rolling contact surface of said outer ring on the vehicle outer side, and a plurality of tapered rollers arranged between the rolling contact surfaces of said outer ring and both the inner rings,

30 wherein a shaft end on vehicle inner side of said hub wheel is bent outwardly in a radial direction so as to be caulked to an end surface of said inner ring on the vehicle

inner side in said tapered roller bearing,

wherein a raceway track of at least one of said outer ring and said inner ring on the vehicle inner side in said tapered roller bearing is designed so as to satisfy a  
5 condition that a predetermined form is secured in a state that the raceway track is elastically deformed due to the caulking.

18. The vehicle-use bearing apparatus according to claim 17, wherein the condition is such that forms of the  
10 raceway tracks of said inner and outer rings before the caulking are set so that extended lines along the rolling contact surfaces of said outer and inner rings and an extended line along an outer peripheral surface of said tapered roller meet at a rotational axis of said hub wheel after the  
15 caulking.

19. A vehicle-use bearing apparatus comprising:

a hub wheel having a center hole to which a wheel is attached;

a double row tapered roller bearing with vertex of  
20 contact angles outside of bearing to be attached to an outer periphery of said hub wheel; and

an equal velocity joint to be attached to the center hole of said hub wheel so as to be rotatively integrally with said hub wheel in a state that said joint is close to said  
25 tapered roller bearing,

wherein said tapered roller bearing includes a single outer ring having two row rolling contact surfaces adjacent in an axial direction, a plurality of tapered rollers arranged on said two row rolling contact surfaces, and an  
30 inner ring which has a single rolling contact surface paired with the rolling contact surface on a vehicle inner side of said outer ring and is fitted to the vehicle inner side on

an outer peripheral surface of said hub wheel, and a required area of the outer peripheral surface of said hub wheel is utilized as a rolling contact surface paired with the rolling contact surface on the vehicle outer side of said outer ring,

5        wherein a shaft end on the vehicle inner side of said hub wheel is bent outwardly in a radial direction so as to be caulked to an end surface of said inner ring of said tapered roller bearing,

10        wherein a raceway track of at least one of said outer ring and said inner ring in said tapered roller bearing is designed so as to satisfy a condition that a predetermined form is secured in a state that the raceway track is elastically deformed due to the caulking.